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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/659,329	09/11/2003	Shogo Matsubara	2003-1114A	3777

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EXAMINER	
MRUK, GEOFFREY S	

ART UNIT	PAPER NUMBER
2853	

DATE MAILED: 05/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/659,329	MATSUBARA ET AL.	
	Examiner	Art Unit	
	Geoffrey Mruk	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 September 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10 February 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

Figure 12 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 4 and 14 are objected to because of the following informalities: The variable y is not defined in claim 4. The variable y is not defined in claim 14, line 5. The Examiner construes that the variable y is between 0.4 and 0.7. For examination purposes, the Examiner will treat the variable y to be 0.4-0.7 (Page 13, lines 3-10). If applicant intended to define the term y otherwise, they are advised to change in the next response. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 and 3-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Qui et al. (US 6,142,615).

With respect to claim 1, Qui discloses a piezo-electric film element (Fig. 9, element 4c) comprising:

- a substrate (Fig. 9, element 2);
- a first electrode (Fig. 9, element 3) formed on said substrate;
- a dielectric film (Fig. 9, elements 41-46) formed on said first electrode, said dielectric film including a piezo-electric layer (Fig. 9, elements 41, 42) and including a stress-reducing layer (Fig. 9, elements 43-46) for reducing a stress between said substrate and said dielectric film (Column 17, lines 10-63); and
- a second electrode (Fig. 9, element 40) formed on said dielectric film.

With respect to claim 3, Qui discloses a piezo-electric layer (Fig. 9, elements 41, 42) comprises an oxide solid-solution having a perovskite structure expressed by a chemical formula ABO_3, including at least one A element selected from a group consisting of Pb, Ba, Nb, La, Li, Sr, Bi, Na and K, and including at least one B element

selected from a group consisting of Cd, Fe, Ti, Ta, Mg, Mo, Ni, Nb, Zr, Zn, W and Yb (Column 6, lines 16-55; Column 17, lines 19-36).

With respect to claim 4, Qui discloses a piezo-electric layer comprises a PZT film expressed by a formula: $Pb_{1+x}(Z_y+Ti_{1-y})O_3$ (x=0-0.5) (Column 6, lines 30-55).

With respect to claim 5, Qui discloses a stress-reducing layer (Fig. 9, elements 43-46) comprises a metal material or an oxide of said metal material, said metal material comprising at least one of the platinum group of precious metals (Column 6, lines 45-55; Column 17, lines 19-36).

With respect to claim 6, Qui discloses a wherein a heat expansion coefficient of said stress-reducing layer (Fig. 9, elements 43-46) is different than a heat expansion coefficient of said piezoelectric layer (Fig. 9, elements 41, 42). "Specifically, the composition represented by equation (1) or (2) in Embodiment 1 is used for the first piezoelectric layer 41, PZT is used for the second piezoelectric layer 42, and a mixture of the compositions represented by equations (1) and (2) is used for the third piezoelectric layers 43 to 46. The composition obtained by, for example, changing metal elements b and b' in equations (1) and (2) is employed for each of the third piezoelectric layers 43 to 46." (Column 17, lines 30-34). Therefore, the heat expansion coefficient of the stress-reducing layer is different than the heat expansion coefficient of the piezoelectric layer since different combinations of elements as disclosed by Qui, can be used for the respective layers.

With respect to claim 7, Qui discloses a piezo-electric layer and said stress depressing layer comprises an oxide solid-solution having a perovskite structure

expressed by a chemical formula ABO_3, including at least one A element selected from a group consisting of Pb, Ba, Nb, La, Li, Sr, Bi, Na and K, and including at least one B element selected from a group consisting of Cd, Fe, Ti, Ta, Mg, Mo, Ni, Nb, Zr, Zn, W and Yb (Column 6, lines 16-55; Column 17, lines 19-36).

With respect to claim 8, Qui discloses a piezo-electric layer comprises a PZT film expressed by a formula: $Pb_{1+x}(Zr_y+Ti_{1-y})$O.sub.3 (x=0-0.5, y=0.5-0.6) (Column 6, lines 16-55; Column 17, lines 19-36), and said stress-reducing layer comprises a PZT film expressed by a formula: $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5, y=0.1-0.3) (Column 6, lines 16-55; Column 17, lines 19-36).

With respect to claim 9, Qui discloses an actuator (Fig. 9) comprising the piezo-electric film element of claim 1 and a vibration plate (Fig. 9, element 3) formed adjacent to the piezo-electric film element.

With respect to claim 10, Qui discloses an ink-jet head comprising (Fig. 3, element 101) a plurality of actuators (Fig. 4, element 4), each of the actuators comprising the actuator of claim 9, a plurality of pressure chambers (Fig. 4, element 21) corresponding to the plurality of actuators, and a plurality of nozzles (Fig. 4, element 11) corresponding to the plurality of pressure chambers, the plurality of nozzles being operable to eject ink droplets (Column 5, lines 41-56).

With respect to claim 11, Qui discloses an ink-jet recording apparatus comprising the ink-jet head of claim 10, a controller for controlling the ink-jet head, and an ink receiver for supplying ink to said ink-jet head (Column 5, lines 41-56).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Qui et al. (US 6,142,615) in view of Wakita et al. (US 4,978,881).

Qui discloses a piezo-electric film element that includes a stress-reducing layer (Column 17, lines 10-63).

Qui fails to disclose a stress reducing layer that is electrically insulated from said first electrode and said second electrode, and a Young's modulus of said stress-reducing layer is smaller than a Young's modulus of said piezo-electric layer.

Wakita discloses a piezoelectric actuator of lamination type in which a stress-reducing layer (Fig. 3, element 13) is electrically insulated from said first electrode (Fig. 3, element 10a) and said second electrode (Fig. 3, element 10b), and a Young's modulus of said stress-reducing layer is smaller than a Young's modulus of said piezo-electric layer (Column 3, lines 44-62).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Wakita in the piezoelectric film element of Qui. The motivation for doing so would have been "the internal stress produced in each insulating space defined on the main surfaces of the each element can be absorbed or reduced by the inserted elastic member, and therefore the actuator can be stably operated over a long period without producing of any crack" (Column 4, lines 24-31).

2. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Qui et al. (US 6,142,615) in view of Sugiura et al. (US 6,338,551 B1).

Qui discloses a substrate (Fig. 9, element 2), a first electrode (Fig. 9, element 3) formed on the substrate, a dielectric film (Fig. 9, elements 41-46) formed on the first electrode, and a second electrode (Fig. 9, element 40) formed on the dielectric thin film, wherein the substrate comprises one of a first substrate (Fig. 9, elements 41, 42) and a second substrate (Fig. 9, elements 43-46) and wherein if the substrate comprises the first substrate, the dielectric film comprises a first dielectric film having a composition expressed by a formula: $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5, y=0.4-0.5) (Column 6, lines 16-55; Column 17, lines 19-36), and if the substrate comprises the second substrate, the dielectric film comprises a second dielectric film having a composition expressed by a formula: $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5, $0.5<y\leq0.7$) (Column 6, lines 16-55; Column 17, lines 19-36).

Qui fails to disclose the heat coefficients of the first and second substrates.

Sugiura discloses a first substrate (Fig. 2, element 42) having a thermal expansion coefficient of about $2.0x10^{-6}$and a second substrate (Fig. 2, element 41) having a thermal expansion coefficient of about $7.5x10^{-6}$ (Column 6, lines 20-33).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Sugiura in the piezoelectric film element of Qui. The motivation for doing so would have been "since the thermal expansion coefficients are approximate to each other between these constitutional elements of the actuator 40, even in case that the actuator 40 is heated and the temperature thereof is raised to be equal to or higher than about 120 degrees C, the degrees of the expansions of these constitutional elements are approximate to each other. Thus, it is possible to restrain the positional shift or drift between the position of the piezoelectric element 42a and the position of the ink storing chamber 44b corresponding to each other" Column 6, lines 34-42).

3. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sumi et al. (US 6,194,818 B1) in view of Sugiura et al. (US 6,338,551 B1).

Sumi discloses a piezo-electric film element (Fig. 1) comprising a substrate (Fig. 1, element 11) having a heat expansion coefficient, a first electrode (Fig. 1, element 14) formed on the substrate, a dielectric film formed on the first electrode (Fig. 1, element 15), the dielectric film comprising a tetragonal structure of an oxide having a perovskite structure, a second electrode (Fig. 1, element 16) formed on the dielectric film. The c-axis oriented rate defined on page 17, lines 15-16 is inherent in the prior art or

alternatively, it would have been an obvious choice to align the dielectric layers in such a tetragonal orientation, disclosed by Sumi (Column 3, lines 29-35; Column 6, lines 49-59).

Sumi fails to disclose the heat coefficients of the dielectric film and the substrate.

Sugiura discloses a first substrate (Fig. 2, element 42) having a thermal expansion coefficient of about $2.0x10^{-6}$and a second substrate (Fig. 2, element 41) having a thermal expansion coefficient of about $7.5x10^{-6}$ (Column 6, lines 20-33).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Sugiura in the piezoelectric film element of Qui. The motivation for doing so would have been "since the thermal expansion coefficients are approximate to each other between these constitutional elements of the actuator 40, even in case that the actuator 40 is heated and the temperature thereof is raised to be equal to or higher than about 120 degrees C, the degrees of the expansions of these constitutional elements are approximate to each other. Thus, it is possible to restrain the positional shift or drift between the position of the piezoelectric element 42a and the position of the ink storing chamber 44b corresponding to each other" Column 6, lines 34-42).

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sumi et al. (US 6,194,818 B1) in view of Sugiura et al. (US 6,338,551 B1).

Sumi discloses a piezo-electric film element (Fig. 1) comprising a substrate (Fig. 1, element 11), a first electrode (Fig. 1, element 14) formed on the substrate, a dielectric

film (Fig. 1, element 15) formed on the first electrode, the dielectric film having a composition expressed by a formula $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5) and having a tetragonal structure. A second electrode formed on the dielectric film wherein if the substrate comprises the first substrate, the dielectric film comprises a first dielectric film having a composition expressed by a formula $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5, y=0.4-0.5), and if the substrate comprises the second substrate, said dielectric film comprises a second dielectric film having a composition expressed by a formula $Pb_{1+x}(Zr_y+Ti_{1-y})O_3$ (x=0-0.5, $0.5<y\leq0.7$) (Column 6, lines 1-59).

Sumi fails to disclose a first substrate having a heat expansion coefficient of 20-40 x 10^{-7} (K^{-1}) and a second substrate having a heat expansion coefficient of 60-150 x 10^{-7} (K^{-1}).

Sugiura discloses a first substrate (Fig. 2, element 42) having a thermal expansion coefficient of about $2.0x10^{-6}$and a second substrate (Fig. 2, element 41) having a thermal expansion coefficient of about $7.5x10^{-6}$ (Column 6, lines 20-33).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Sugiura in the piezoelectric film element of Qui. The motivation for doing so would have been "since the thermal expansion coefficients are approximate to each other between these constitutional elements of the actuator 40, even in case that the actuator 40 is heated and the temperature thereof is raised to be equal to or higher than about 120 degrees C, the degrees of the expansions of these constitutional elements are approximate to each other. Thus, it is possible to restrain the positional shift or drift between the position of the piezoelectric element 42a and the

position of the ink storing chamber 44b corresponding to each other" Column 6, lines 34-42).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Geoffrey Mruk whose telephone number is (571) 272-2810. The examiner can normally be reached on 7am - 330pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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4/26/05
MANISH S. SHAH
PRIMARY EXAMINER